RINGKASAN

Biogas merupakan salah satu sumber energi alternatif yang dihasilkan dari proses fermentasi bahan organik secara anaerob (tertutup dari udara bebas) untuk menghasilkan gas yang sebagian besar berupa gas metana (CH_4) dan karbondioksida (CO_2). Pada kandungan biogas terdapat gas pengotor yaitu CO_2. Salah satu cara untuk meningkatkan kualitas biogas agar kandungan gas metana pada biogas meningkat dan menurunkan gas-gas pengotor seperti CO_2 yaitu dilakukan proses pemurnian biogas menggunakan *purifier* yang berisi adsorben yaitu arang aktif dan silika gel. Penelitian ini bertujuan untuk 1) mengetahui faktor-faktor yang mempengaruhi pada proses produksi biogas, dan 2) mengetahui proses peningkatan kualitas biogas melalui proses pemurnian dan mengetahui kualitas biogas setelah melalui proses pemurnian menggunakan *Down-Up Purifier* dengan arang aktif dan silika gel sebagai adsorben.

Penelitian dilaksanakan di Laboratorium Teknik Sistem Termal dan Energi Terbarukan, Jurusan Teknologi Pertanian, Fakultas Pertanian, Universitas Jenderal Soedirman dan Laboratorium Teknik Pengolahan Pangan dan Hasil Pertanian, Jurusan Teknologi Pertanian, Fakultas Pertanian, Universitas Jenderal Soedirman dari bulan September sampai Desember 2019. Variabel yang diukur dalam penelitian ini yaitu rasio C/N, suhu lingkungan, suhu substrat, derajat keasaman (pH), produksi biogas, *Total Solid* (TS), *Volatile Solid* (VS), *Chemical Oxygen Demand* (COD), dan *Biologycal Oxygen Demand* (BOD) yang berpengaruh terhadap produksi gas metan. Kandungan gas metana (CH_4) dan karbondioksida (CO_2) setelah dimurnikan, dan waktu optimal untuk proses pemurnian biogas, perlakuan yang diberikan menggunakan 3 kali waktu pengujian, yaitu 30 menit, 60 menit dan 90 menit. Percobaan dilakukan pengulangan sebanyak tiga kali. Variabel lain yaitu massa adsorben, warna api, dan nilai kalor.

Hasil penelitian menunjukkan bahwa rasio C/N untuk sampel pertama sebesar 38,84 dengan perbandingan C = 40,670 dan N = 1,047, dan untuk sampel kedua sebesar 36,37 dengan perbandingan C = 43,794 dan N = 1,204 dengan suhu substrat rata-rata 28,6^{o}C, suhu lingkungan bola basah rata-rata 26^{o}C dan suhu lingkungan bola kering rata-rata 27 ^{o}C serta pH rata-rata 5,9. Nilai COD awal, tengah, dan akhir masing-masing sebesar 313.500,00 mg/l, 19.100,00 mg/l dan 29.100,00 mg/l dan nilai BOD awal, tengah, dan akhir masing-masing sebesar 960,12 mg/l, 5.890,00 mg/l dan 9.312,53 mg/l. Kemudian nilai *total solid* mengalami penurunan sebesar 0,61% dan 0,83%, dan *volatile solid* mengalami kenaikan sebesar 0,06% dan 0,15%. Penggunaan adsorben arang aktif dan silika gel dapat menurunkan kandungan gas CO_2 sebesar 78,2% dan kandungan gas CH_4 sebesar 68,4% dengan waktu pemurnian paling optimal yaitu 30 menit.

SUMMARY

Biogas is an alternative energy source which is produced from anaerobic fermentation process (closed from free air) to produce gas which is mostly in the form of methane (CH_4) and carbon dioxide (CO_2). In the biogas content there is impurity gas, namely CO_2. One way to improve the quality of biogas so that the methane gas content in biogas increases and decreases impurity gases such as CO_2 is the process of purifying the biogas using a purifier containing adsorbent namely activated charcoal and silica gel. This study aims to 1) determine the factors that influence the biogas production process, and 2) know the process of improving the quality of biogas through the refining process and determine the quality of biogas after going through the refining process using Down-Up Purifier with activated charcoal and silica gel as an adsorbent.

The research was carried out at the Thermal System and Renewable Energy Engineering Laboratory, Department of Agricultural Technology, Faculty of Agriculture, Jenderal Soedirman University and Laboratory of Food Processing and Agricultural Product Engineering, Department of Agricultural Technology, Faculty of Agriculture, Jenderal Soedirman University from September to December 2019. Measured variables In this research, the C/N ratio, ambient temperature, substrate temperature, acidity (pH), biogas production, Total Solid (TS), Volatile Solid (VS), Chemical Oxygen Demand (COD), and Biologycal Oxygen Demand (BOD) which affects the production of methane gas. The content of methane gas (CH_4) and carbon dioxide (CO_2) after purification, and the optimal time for the biogas purification process, the treatment is given using 3 times the testing time, namely 30 minutes, 60 minutes and 90 minutes. The experiment was repeated three times. Other variables are the mass of the adsorbent, the color of the fire, and the heating value.

The results showed that the C/N ratio for the first sample was 38.84 with a ratio of C = 40.670 and N = 1.047, and for the second sample 36.37 with a ratio of C = 43.794 and N = 1.204 with an average substrate temperature of 28.6^oC, the average temperature of the wet ball environment is 26^oC and the average temperature of the dry ball environment is 27^oC and the average pH is 5.9. Initial, middle, and final COD values of 313,500.00 mg/l, 19,100.00 mg/l and 29,100.00 mg/l and initial, middle and final BOD values respectively 960.12 mg/l, 5.890,00 mg/l and 9.312,53 mg/l. Then the total value of solid decreased by 0.61% and 0.83%, and volatile solid increased by 0.06% and 0.15%. The use of activated charcoal adsorbents and silica gel can reduce CO_2 gas content by 78.2% and CH_4 gas content by 68.4% with the most optimal purification time of 30 minutes.